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The Effect of Advertising on Attitudes Toward Tobacco Use and Decisions About Smoking Among Virginia Adolescents

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**The Effect of Advertising on Attitudes
toward Tobacco Use and Decisions
about Smoking among Virginia Adolescents**

by

John Rosser Matthews, III

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Department of Epidemiology and Community Health
Master of Public Health Program
MPH Research Project: EPID 691

Virginia Commonwealth University
Richmond, Virginia

August 2006

**Master of Public Health
Research Project Agreement Form**
Department of Epidemiology and Community Health

Student name: J. Rosser Matthews E-mail address:

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Home phone: () Work phone: () Fax:

Number of semester hours (3-6): 3 _____ Semester: Summer ___ Year: 2006 _____

A. PROJECT TITLE: The Effect of Advertising on Attitudes toward Tobacco Use and Decisions about Smoking among Virginia Adolescents

B. PURPOSE (state hypothesis/research question): To see whether the attitudes of Virginia adolescents toward tobacco use and decisions about whether to engage in smoking are related to whether they have seen tobacco product advertisements or antismoking messages in the media.

C. SPECIFIC OBJECTIVES (list major aims of the study): 1) to determine whether exposure to media (e.g., antismoking messages or tobacco advertisements) is associated with adolescent health perceptions of tobacco; 2) to determine whether media exposure is associated with adolescent intention to quit using tobacco or remain tobacco free.

D. DESCRIPTION OF METHODS

- D.1. Identify source(s) of data (eg, existing data set, data collection plans, etc):* Although the YRBSS will be used to assess overall national trends in adolescent smoking, the primary data source will be data collected by the Virginia Youth Tobacco Evaluation Project (YTEP). The YTEP survey is a self-administered questionnaire distributed and completed in participating agencies and institutions throughout Virginia.
- D.2. State the type of study design (eg, cross-sectional, cohort, case-control, intervention, etc):*
Cross-sectional survey
- D.3. Describe the study population and sample size:* The population consisted of 11,128 middle school children (6th-8th graders) at various participating agencies and institutions throughout Virginia. This study will focus on this age group because this is the age at which several health-related habits (including the decision of whether or not to smoke) are being formed.
- D.4. List variables to be included (If a qualitative study, describe types of information to be collected) :* The main outcome variables are: beliefs regarding health effects of smoking, likelihood of smoking in future, future plans for quitting smoking. Independent variables include: exposure to advertisements with tobacco products, exposure to antismoking messages in the media. Potential confounders include: subjects' smoking status, friends' smoking status, parents' and siblings' smoking status, parental and friends attitudes towards smoking, number of people in household who smoke,

importance of religion, hours of TV watched, access to tobacco products, amount of parental formal education, and level of academic performance (average grade in school). Analyses will be adjusted for gender, race, grade level, and agency.

D.5. Describe methods to be used for data analysis (If a qualitative study, describe general approach to compiling the information collected) SAS will be used to generate descriptive statistics. To accomplish the aforementioned specific objectives, multiple logistic and linear regression will be used as appropriate. Specifically, these analyses will be used to determine how beliefs regarding health effects of smoking, likelihood of smoking in future, and future plans for quitting smoking are associated with exposure to advertisements with tobacco products and exposure to antismoking messages in the media while controlling for potential confounding variables. All analyses will take into account the clustered sampling scheme.

E. ANTICIPATED RESULTS: Adolescents exposed to antismoking messages and not exposed to tobacco product advertising will be more likely to believe that smoking is unhealthy and less likely to take up or continue the practice whereas adolescents exposed to tobacco product advertising and not exposed to antismoking messages will be less likely to believe that smoking is unhealthy and more likely to take up or continue the practice.

F. SIGNIFICANCE OF PROJECT TO PUBLIC HEALTH: Research has demonstrated that tobacco control expenditures are associated with lower per capita consumption of tobacco and lower youth smoking rates. After the 1998 tobacco settlement, tobacco companies have launched media campaigns, which, although discouraging youth smoking, do not address the health consequences of smoking. In a recent nationally-based study of these competing media sources, Wakefield et al. (2005) has argued that “Research is needed to determine whether . . . [tobacco company] advertising may dilute or undermine the established benefits of tobacco control-sponsored campaigns.” By considering both exposure to tobacco advertising and antismoking media messages, this study will address this question as it relates to the smoking behaviors of Virginia adolescents.

G. IRB Status:

- 1) Do you plan to collect data through direct intervention or interaction with human subjects? ___yes ___X_no
- 2) Will you have access to any existing identifiable private information? ___yes ___X_no

If you answered “no” to both of the questions above, IRB review is not required.
If you answered “yes” to either one of these questions, your proposed study must be reviewed by the VCU Institutional Review Board (IRB). Please contact Dr. Turf or Dr. Buzzard for assistance with this procedure.

Please indicate your IRB status:

- ___ to be submitted (targeted date _____)
 ___ submitted (date of submission _____; VCU IRB # _____)
 ___ IRB exempt review approved (date _____)
 ___ IRB expedited review approved (date _____)
 ___ IRB approval not required

H. PROPOSED SCHEDULE: Start Date: May 15, 2006 Anticipated End Date: July 28, 2006

I. INDICATE WHICH OF THE FOLLOWING AREAS OF PUBLIC HEALTH KNOWLEDGE WILL BE DEMONSTRATED:

1. Biostatistics – collection, storage, retrieval, analysis and interpretation of health data; design and analysis of health-related surveys and experiments; and concepts and practice of statistical data analysis. _X_ yes _no (if yes, briefly describe): Analyzing YTEP data with multiple regression using SAS software.
2. Epidemiology – distributions and determinants of disease, disabilities and death in human populations; the characteristics and dynamics of human populations; and the natural history of disease and the biologic basis of health. _X_ yes _no (if yes, briefly describe): A discussion of the health risks from smoking will be provided. The descriptive characteristics and prevalence of risk factors will be described. Adjusted analyses exploring the association between the independent and the dependent variables will be given.
3. Environmental Health Sciences – environmental factors including biological, physical and chemical factors which affect the health of a community. _yes _X_ no (if yes, briefly describe):
4. Health Services Administration – planning, organization, administration, management, evaluation and policy analysis of health programs. _yes _X_ no (if yes, briefly describe):
5. Social/Behavioral Sciences – concepts and methods of social and behavioral sciences relevant to the identification and the solution of public health problems. _X_ yes _no (if yes, briefly describe): A discussion of the addictive nature of nicotine as rationale for primary prevention (i.e., preventing adolescents from taking up smoking) will be provided. A discussion of the various psychological theories of how individuals respond to advertising and the role of advertising in changing behavior will be provided.

Submission Statement

Master of Public Health Research Project

This MPH Research Project report is submitted in partial fulfillment of the requirements for a Master of Public Health degree from Virginia Commonwealth University's School of Medicine. I agree that this research project report be made available for circulation in accordance with the program's policies and regulations pertaining to documents of this type. I also understand that I must receive approval from my Faculty Advisor in order to copy from or publish this document, or submit to a funding agency. I understand that any copying from or publication of this document for potential financial gain is not allowed unless permission is granted by my Faculty Advisor or (in the absence of my Faculty Advisor) the Director of the MPH Program.



Student Signature

August 10, 2006
Date

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**The Effect of Advertising on Attitudes toward Tobacco Use and Decisions
about Smoking among Virginia Adolescents**

Abstract:

Purpose: This study seeks to determine 1) whether the type of advertising exposure is associated with adolescent health perceptions of tobacco use, and 2) whether the type of media exposure is associated with initiation plans (non-smokers) or quitting plans (smokers).

Methods: This was a cross-sectional survey of middle school students (n=11,128). Psychosocial variables were knowledge of the risks of tobacco use (range: 3-15) and benefits of being tobacco free (range: 7-35) with higher scores indicating greater understanding. Intentions to quit or initiate were construed as binary variables. Exposure variables were tobacco advertisements or anti-tobacco media messages. Covariates were gender, race, grade level, and parental closeness. The data were analyzed using SAS, version 9.1 and hierarchical regression was used to account for random effects of students nested within organizations.

Results: Exposure to tobacco advertising was associated with higher knowledge (12.6 v. 12.4, $p < 0.0001$). Exposure to anti-tobacco messages was associated with higher benefits (27.5 v. 26.1, $p < 0.0001$), but exposure to tobacco advertising and benefits were not significantly associated (27.0 v. 27.1, $p = 0.0879$). Among 8th graders, exposure to tobacco messages was associated with higher percentages planning to initiate (19.7 v. 16.2, $p = 0.008$) whereas anti-tobacco exposure was associated with lower percentages (16.3 v. 20.3, $p = 0.024$). Exposure to more than one anti-tobacco message was associated with higher knowledge and benefit.

Conclusions: Counter-advertising can make adolescents more aware of health benefits of remaining tobacco free. Placing tighter restrictions on tobacco advertising directed at adolescents is warranted. The “dose-response” suggests disseminating anti-tobacco messages in many venues.

INTRODUCTION:

Public Health Consequences of Adolescent Tobacco Use

As the Centers for Disease Control and Prevention (CDC) has documented, there are multiple health and economic consequences that follow from adolescent tobacco use. Tobacco use causes more deaths each year than all deaths from HIV-AIDS, illegal drug use, alcohol use, motor vehicle injuries, suicides, and murders combined.¹ Among the health effects of smoking include a much higher risk of dying from lung cancer (22 times higher among men and 12 times higher among women relative to nonsmokers) and an increased risk of many other types of cancer (e.g., cancers of the lip, oral cavity, and pharynx; esophagus; pancreas; larynx; uterine cervix; bladder; and kidney). Smoking also increases the risk of heart disease and stroke, two other leading causes of mortality. Among women in their reproductive years, smoking leads to an increased risk of infertility, preterm delivery, still birth, low birth weight, and sudden infant death syndrome (SIDS); among postmenopausal women, smokers have lower bone density than those who never smoked (i.e., greater risk of broken bones after a fall).² Overall, cigarette smoking is the leading preventable cause of death in the United States and accounts for approximately 440,000 deaths annually and the annual health-related costs to society from treating tobacco induced illnesses exceeds \$167 billion.³

Also, despite prohibitions in all states against underage tobacco use, the vast majority of smokers—approximately 80%—start using tobacco before they reach 18 years of age.⁴ Among those currently under 18 years of age, it is estimated that approximately 6.4 million will die prematurely because they began to smoke as adolescents.

Cigarette Advertising: The Legal, Scientific, and Ethical Issues

Throughout much of the 20th century, advertising has been a central battleground between the tobacco industry and its opponents—especially following the 1964 Surgeon General’s Report that established a link between cigarette smoking and lung cancer.⁵ In 1998, as part of an extensive legal settlement with 46 states and six U.S. territories, the tobacco industry accepted many restrictions on its advertising practices—including restrictions on outdoor advertising, the use of cartoon characters in advertisements, and the sponsorship of sporting events.⁶ Despite this settlement, legal battles over advertising between the states and the tobacco industry have continued. In 2001, the Supreme Court decided the case of *Lorillard v. Reilly* in which tobacco companies had sued the Attorney General of the State of Massachusetts for promulgating a series of regulations on the advertising of cigarettes (e.g., outdoor advertisements for cigarettes were forbidden within a 1000 foot-radius of a public playground, playground area of a public park, or secondary or elementary school). The tobacco companies contended that these regulations violated the Supremacy Clause of the U.S. Constitution⁷ because the Massachusetts law was inconsistent with the Federal Cigarette Labeling and Advertising Act (FCLLA).⁸ Despite holding in favor of the tobacco companies, the Supreme Court still asserted that “tobacco use, particularly among children and adolescents, poses perhaps the single most significant threat to public health in the United States” and that “To the extent that federal law and the First Amendment do not prohibit state action, States and localities remain free to combat the problem of underage tobacco use by appropriate means.”⁹ In response, tobacco companies have continued to introduce lawsuits to try to prevent the airing of anti-tobacco media messages (predicated on the argument that taxpayer money should not be spent attacking law-abiding

companies¹⁰). These ongoing legal struggles make clear the need to assess empirically the effectiveness of these counter-advertising campaigns.

In addition to these legal and policy considerations, there are compelling scientific and ethical reasons for media campaigns to discourage adolescent smoking. Scientifically, the known health risks from smoking have been widely documented; tobacco smoke contains more than 60 known carcinogens (i.e., cancer causing chemicals).¹¹ Ethically, permitting adolescents, in particular, to smoke is problematic because cigarettes also contain nicotine, a drug with well documented addictive properties. Researchers have determined that, physiologically, nicotine acts on particular receptors in the brain to generate compulsive, repetitive behavior. Based on these findings, the World Health Organization (WHO) and the American Psychiatric Association (APA) have classified nicotine as a “dependence-inducing drug.”¹² According to the WHO/APA criteria, nicotine dependence is indicated whenever an individual uses tobacco continuously for at least one month with unsuccessful attempts to stop or significantly reduce tobacco consumption.¹³ As the 1988 Surgeon General’s report on nicotine addiction observed, 1) cigarettes and other forms of tobacco are addicting; 2) nicotine is the drug in tobacco that causes addiction; and 3) the pharmacologic and behavioral processes that determine tobacco addiction are similar to those that determine addiction to drugs such as heroin and cocaine.¹⁴ Because adolescents are not developmentally mature enough to appreciate fully both the health risks and addictive nature of smoking, there are ethically compelling reasons to try to prevent adolescents from taking up the practice of smoking¹⁵—through targeted media campaigns and other prevention strategies. The effects of these media campaigns have been widely studied in the published literature and some of the findings from this literature will now be discussed.

Effects of Industry Advertising and Counter-advertising on Adolescent Smoking Behavior

Prior to the 1998 settlement, there were many studies on the role of tobacco advertising on adolescents' perception of smoking and their intention to initiate smoking. The widespread knowledge of tobacco advertising among youths and adolescents has been well documented. Studies from the early and mid 1990s found that from 75% to 81% of 6-year-olds in the United States were familiar with the Joe Camel cartoon character.^{16,17,18} Among California adolescents aged 12 to 13 years, almost 60% who had never smoked could still identify a favorite cigarette advertisement.¹⁹ A 1993 survey found that more than 80% from a national sample of American nonsmoking adolescents, aged 12 to 17 years, were familiar with tobacco promotional campaigns.²⁰ In a recent survey of these and other studies—that involved summarizing the results of prospective, cross-sectional, and time-series data—DiFranza and his colleagues found that exposure of adolescents to tobacco promotion fostered positive beliefs about tobacco use, increased the risk of initiating smoking, and that there was a dose-response relationship (i.e., higher exposure resulted in higher risk of initiation).²¹

Since the 1998 settlement agreement, the tobacco industry has modified its advertising strategies. In particular, the tobacco industry has become involved in advertising campaigns to discourage underage smoking and the effects of these campaigns has been the subject of empirical studies using a variety of methodologies. In two separate research studies employing a randomized controlled trial methodology, Henriksen and colleagues in California exposed groups of young adults to tobacco company sponsored advertisements and advertisements from other companies and asked the participants to rate the effectiveness of these advertisements.^{22,23} In their first study the researchers used a convenience sample (n=218) of college students.²² At baseline, all of the participants answered an anonymous questionnaire on their views of Philip

Morris and several other corporations. Also, all participants saw four corporate advocacy campaigns sponsored by Pfizer and Chevron. Random assignment then determined which participants saw four Philip Morris smoking prevention advertisements, four Philip Morris charitable works advertisements, or four Anheuser-Busch advertisements about not engaging in underage drinking (the control group). After each commercial, the participants completed a brief evaluation of the advertisement—including questions about the corporate sponsors and the industries they represented. Henriksen and colleagues found that Philip Morris advertisements were rated less favorably by students who were aware that the sponsor was a tobacco company than by those who were unaware ($p < 0.001$).

In their more recent study, Henriksen and colleagues tried to determine whether exposure to industry-sponsored advertisements may generate more favorable attitudes towards tobacco companies and, as a result, greater odds of taking up smoking (i.e., what the authors dubbed the “boomerang effect”).¹⁷ Henriksen and colleagues again relied on a convenience sample—9th and 10th graders ($n=832$) ages 14 to 17 at a public high school in California—and they compared responses of adolescents exposed to five smoking prevention advertisements sponsored by tobacco companies, five smoking prevention advertisements sponsored by a non-profit organization (the American Legacy Foundation), or five advertisements about preventing drunk driving (the control group). In questionnaires, the participants were asked to assess the effectiveness of the advertisements and their general level of sympathy toward to tobacco industry. The researchers found that respondents did not perceive the tobacco-industry sponsored advertisements (by Philip Morris and Lorillards) to be as effective as the advertisements sponsored by a non-profit agency ($p < 0.001$), but they found that those exposed to Philip Morris and Lorillards advertisements were more sympathetic towards cigarette companies

than other experimental groups ($p < 0.001$). Based on these findings, the authors concluded that the tobacco companies, through their education campaigns, were successful in garnering public sympathy and, as a result, they advocated that counter-advertising be introduced to offset this effect.

One of the most prominent of these counter-advertising efforts nationally has been the truth® campaign of the American Legacy Foundation (ALF), a non-profit organization established, in March 1999, to prevent adolescent smoking and help adults quit smoking; the ALF was created through funds provided by the 1998 tobacco settlement.²⁴ The truth® campaign was launched in February 2000 and relied on graphic images to depict the death and disease caused by tobacco and attempted to expose the manipulative marketing practices of the tobacco industry. For example, a “body bags” commercial showed adolescents piling 1,200 body bags outside a tobacco company headquarters to highlight the daily death toll from tobacco consumption.

Based on telephone surveys of adolescents conducted before and after the truth® campaign was launched, the consensus is that it has been effective at inducing negative attitudes towards the tobacco industry among adolescents; the presumption of these studies is that these negative attitudes may result in fewer adolescents beginning to smoke. In 1999, the ALF initiated the Legacy Media Tracking Survey (LMTS), which was designed to be a telephone-based, nationally representative sample of adolescents ages 12 to 17 and young adults ages 18 to 24. A stratified-design survey was conducted before the truth® campaign was launched (on February 7, 2000) and follow-up surveys were conducted after the campaign was launched; the baseline telephone survey was conducted in the two months immediately prior to the launch of the campaign and the initial follow-up survey was conducted in the last quarter of 2000. In the

survey, adolescents were asked how strongly they agreed or disagreed (on a 5-point scale) with a series of statements designed to elicit their attitudes, beliefs, and behavioral intent about the tobacco industry, their belief about whether using tobacco was a socially acceptable activity, and whether they intended to smoke during the next year. Also, the survey contained questions that were designed to determine whether the interviewees were aware of the truth® campaign and the “Think. Don’t Smoke” campaign that was being run by Philip Morris. Farrelly and colleagues concluded that the ALF advertisements did have an effect on adolescents’ beliefs about smoking, tobacco companies, and their intention to smoke. They noted, for example, that there was a doubling of the odds that adolescents would agree with the statement “cigarette companies lie” following exposure to the truth® campaign (OR=1.97, P<0.001).²⁵ In a later survey based on the same dataset, Thrasher and colleagues found that adolescents who lived in tobacco-producing states (i.e., Georgia, North Carolina, South Carolina, Tennessee, Virginia, and Kentucky) were just as receptive to anti-industry media campaigns as their counterparts in non-tobacco producing states.²⁶

Subsequent national surveys of adolescents have similarly shown evidence of the effectiveness of counter-industry advertising. For example, Farrelly and colleagues grouped 210 television markets in the United States into five categories based on the level of exposure of the truth® campaign in each market and were able to show a statistically significant dose-response relationship between truth® campaign exposure and current youth smoking prevalence (odds ratio=0.78; 95% CI=0.63, 0.97).²⁷ Using a national random-digit-dial telephone survey of 6,875 adolescents and young adults (ages 12-24) in 1999-2000, Hersey et al. found that residents in states with strong counter-industry messages as part of their anti-smoking campaigns had lower levels of progression along the “smoking status continuum” (from no intention to smoke to

regular smokers) than their national counterparts in states not using counter-industry messages.²⁸ In a follow-up study, the authors determined that, between 1999 and 2002, the rates of current smoking and established smoking decreased significantly faster in states with counter-industry campaigns than in other states.²⁹

In addition to studies focused on adolescent smoking, insights can also be drawn from anti-smoking media campaigns directed at adult populations because these studies illustrate the psychological dynamics that cause some smokers to be more receptive to media messages than others. In a study by Borland and Balmford, the impact of a national media campaign on a representative sample of 1000 adult smokers in Australia was analyzed.³² Methodologically, the study relied on a repeated measure design that followed two groups of smokers: those who had been potentially exposed to advertising before the initial survey (in Brisbane and Adelaide) and those who had not (in Sydney and Melbourne). By the time of the follow-up interview in two weeks, the researchers presumed that all participants would have been potentially exposed to the media campaign. At follow-up, the researchers determined that 69% (n=605) recalled seeing one of the advertisements and, of these, 58% reported that they were more likely to quit or stay quit, 41% said it made no difference in their intention to quit, and 2% reported that it made them less likely to quit. Overall, the researchers determined that the impact of tobacco related activity on intention to quit smoking was significantly related to perspective at follow-up (chi-square=60.32, $p<0.001$). In general, Borland and Balmford found that, although media campaigns might not be sufficient to induce cessation, they could serve as catalysts among those individuals who had already decided that they wanted to quit smoking.

Based on the studies surveyed above, well-targeted media campaigns by public health agencies do appear to be effective in reducing smoking. Particularly effective are advertisements

that rely on particularly visually striking images (the truth® campaign v. advertisements by tobacco industry) and those that can be successfully targeted at smokers who are already predisposed to quit. However, as Wakefield and colleagues have recently observed, these public health-sponsored anti-tobacco campaigns in the United States are matched or exceeded by tobacco company advertising,³³ which may dilute the effectiveness of public health oriented campaigns. The seriousness of this potential dilution effect is reflected in the results from the National Youth Tobacco Survey (NYTS) for 2001-2002, which indicated that 84.6% of middle school students had seen or heard an antismoking commercial—but an approximately equal number (89.1%) had seen actors smoking on television or in the movies. Also, among middle school children nationally, 42.7% had seen advertisements for tobacco products on the Internet.³⁴ To study these issues among Virginia adolescents, this project will address whether their attitudes toward tobacco use and decisions about whether to engage in smoking are related to whether they have seen tobacco product advertisements and/or anti-smoking messages in the media.

OBJECTIVES

This study has two major objectives, namely 1) to determine whether the type of advertising exposure (anti-smoking message and/or tobacco advertisement) is associated with differing adolescent health perceptions of tobacco use and 2) to determine whether the type of media exposure is associated with differences regarding intention to quit using tobacco or remain tobacco free.

METHODS

This study relied on data collected by the Virginia Youth Tobacco Evaluation Project (YTEP) of Virginia Commonwealth University (VCU), which was made possible by funding provided by the Virginia Tobacco Settlement Foundation. The purpose of the study was to understand tobacco use and other health behaviors among Virginia adolescents so that better health promotion programs for this population could be designed in the future. The VCU Institutional Review Board approved the study.

Surveys were completed anonymously and voluntarily by middle and high school students in schools, churches, and community organizations and the students completed the surveys in a classroom type setting. Once a student completed the survey, it was placed in an envelope and sealed prior to returning it to the instructor. Each survey was assigned an anonymous code to protect privacy and to encourage honest answers by survey participants. This study will report on data from this cross-sectional survey based on the population of 11,128 middle school students (6th to 8th grades) who participated in the baseline, Year 1 survey.

Study variables

The outcome variables fall into two broad categories—namely, psychosocial constructs and intentions. Regarding the psychosocial variables, the focus is on the knowledge of risks from smoking and the health benefits from nonsmoking; regarding intentions, the focus is on the intention to quit smoking for current smokers, or the intention to take up smoking for nonsmokers. For purposes of determining prevalence data, this study construes any participant who even experimented with cigarette smoking (even one of two puffs) as a smoker; however, for purposes of determining whether tobacco advertising or public health counter-advertising

affects the decision to take up or discontinue tobacco use, the study will limit the definition of a regular smoker to an individual who has smoked a cigarette within the last 30 days.

To assess the knowledge regarding the risks from smoking, the survey asked the respondents to designate their views on a five-point scale from “strongly disagree” (1) to “strongly agree” (5) to the following propositions: 1) smoking cigarettes causes cancer; 2) smoking cigarettes causes heart disease; and 3) cigarettes and other tobacco products are addictive. In this analysis, the sum of the responses on these three questions was then computed to determine an outcome variable called “knowledge”, which could take on a range of values from 3 (strongly disagree with all three **propositions**) to 15 (strongly agree with all three propositions). If one of these questions was not answered, then the resulting score from 2-10 was recalibrated to the corresponding value on the 3-15 scale; if two or more of these questions was not answered, then the data for this category were excluded from the analysis. Because these three propositions are all true, a higher numerical score for the “knowledge” variable corresponds to a higher level of correct knowledge regarding the health risks from smoking.

To assess beliefs regarding the benefits of being tobacco-free, the respondents were asked to use the same five-point scale to designate their assessment of the following seven propositions: 1) if I stay tobacco-free, I will be healthier; 2) if I stay tobacco-free, I can become better at sports; 3) if I stay tobacco-free, I will become prettier or better looking; 4) if I stay tobacco-free, I will live longer; 5) if I stay tobacco-free, my hair and skin will be healthy; 6) if I stay tobacco-free, I will gain weight; and 7) if I stay tobacco-free, I will be less popular. The sum of the responses was combined to create a new variable called “benefits of being tobacco-free”, which could take on a range of values from 7 to 35. For the first five propositions, the value that the student checked (1 for “strongly disagree” up to 5 for “strongly agree”) was the

same as the value assigned when the summation was conducted (because each one of these propositions is formulated in terms of the potential *positive* consequences of remaining tobacco free); however, the 6th and 7th questions were “reverse coded” (that is, responders who marked 1 for “strongly disagree” were assigned a value of 5 and vice-versa) because these propositions were formulated in terms of the potential *negative* consequences of remaining tobacco free. As with the “knowledge” variable, up to one of these seven questions could be left unanswered—in which case the resulting score between 6 and 30 would be scaled to the 7 to 35 score range; if more than two questions were left unanswered, the data were excluded from the analysis. As with the knowledge variable, higher scores are indicative of more correct beliefs regarding the benefits of remaining tobacco free.

As already noted, for purposes of assessing the role of advertising and counter-advertising on whether a person takes up smoking or remains tobacco free, smokers were defined as those who indicated they had smoked during the past 30 days. Smokers were then asked a question regarding their plans on quitting smoking with possible responses that included: I have no plans to quit smoking; I’m thinking about quitting smoking; I have strong plans to quit smoking; and I don’t know. For purposes of this study, those who responded that they were thinking about quitting smoking and those who indicated that they had strong plans to quit smoking were considered as affirmatively planning to quit smoking. By contrast, those who responded that they had no plans to quit smoking or were uncertain were considered as not planning on quitting smoking. In other words, the quitting smoking outcome variable was conceived as binary. Similarly, the plan to initiate smoking was conceived as a binary yes/no variable based on a question that was asked in the survey about whether respondents might try smoking within the next six months.

The main exposure variables were seeing advertisements with cigarettes (in magazines, on billboards, at concerts, or sporting events) or seeing anti-tobacco messages in the media. Information regarding these exposures was elicited from questions that asked the students how often they saw cigarette advertisements on a four-point scale from “never” (value=1) to “rarely” (value=2) to “sometimes” (value=3) to “often” (value=4). For purposes of this analysis, only those who responded “often” (4) were designated as having been exposed to cigarette advertisements; all other responses were designated as having not been significantly exposed to cigarette advertising; that is the advertising exposure variable was construed as binary. In the survey, two questions asked about exposure to anti-tobacco media messages. The first question was a yes/no question about whether they had seen anti-tobacco media messages. Among respondents who answered the anti-tobacco media exposure question affirmatively, a second follow-up question asked the responders to designate all of the places they had seen anti-tobacco messages in eight possible categories (e.g., at school, in shopping center/malls, in magazines, on the Internet etc.). These two responses were combined to form a “dose” of anti-tobacco media exposure variable. All of those who responded negatively to the initial question were assigned a value of 0 and all of those who checked one or more boxes in the follow-up question were assigned the value corresponding to the number of boxes that they checked. This meant that the dose variable could take on values between 0 and 8. In the analysis below, the effect of the dose variable will be construed as having three levels—no exposure (value=0), low exposure (value=1), and more exposure (value greater than 1).

Included in the adjusted analyses as covariates were gender (male/female), race (white/non-white), grade level (6th, 7th, 8th) (in the unstratified analyses), and parental connectedness (as determined by questions that asked whether the student was very close to each

parent). For purposes of this study, those who reported not being close and/or not knowing both parents were classified as not close; those who reported being somewhat close to at least one parent were classified as somewhat close; and those who reported being very close to at least one parent were classified as very close.

Statistical Analysis

The data were analyzed using SAS, version 9.1, to generate descriptive statistics of the study population and hierarchical regression techniques were used to take into account the random effects from the study participants being nested within various programs (schools, community organizations etc.) throughout the state. Based on these analyses, the least square mean scores on the psychosocial variables (knowledge and benefits) were estimated (in both crude and adjusted analyses) to determine the students' responses based on their exposure to tobacco media messages or anti-tobacco media messages. Separate hierarchical regressions were performed on the sub-populations of regular smokers and non-smokers to determine whether media exposure was related to the intention to quit among smokers or the intention to initiate smoking among non-smokers. In these analyses, the outcome that is being estimated (in both crude and adjusted analyses) is the percentage of students in each respective category that would either quit smoking or initiate smoking. Because of effect modification based on grade level for intention to try smoking in six months among non-smokers based on exposure to tobacco advertising/counter-advertising, the data were stratified by grade and separate analyses were conducted (both crude and adjusted).

RESULTS

Table 1 shows the sample's descriptive characteristics. There were slightly more females than males in this population (51.7% v. 48.3% respectively). In terms of ethnicity, nearly 72% of the population was white. The majority of the students were in the 6th grade (44.2%) with fewer in the 7th (33.9%) and 8th grades (22%). The vast majority of students (85.1%) reported to being very close to at least one parent. Nearly twice as many students reported having seen anti-tobacco media messages relative to those who had seen tobacco messages (76.6% v. 41.2%) and just over half (50.5%) reported seeing anti-tobacco messages in more than one venue. Nearly a third of the students had experimented with smoking in the sense of taking a few puffs (30.3%), but only 5.0% had already become regular smokers.

The mean age of the population was 12.2 years, the mean score for knowledge of the risks from smoking was 13.2 (range: 3 to 15), and the mean score on the benefits from remaining tobacco free was 28.5 (range: 7 to 35).

Table 2 depicts the mean psychosocial scale scores by exposure to anti-tobacco messages. The mean scale score for knowledge of health risks was 0.9 points higher for those exposed to anti-tobacco messages than for those not exposed in the crude analysis (13.2 v. 12.6) and the mean score was 0.7 points higher for those in the exposure group in the adjusted analysis. The mean score for benefits of being tobacco-free was 1.5 points higher for those exposed to anti-tobacco messages in the crude analysis (28.8 v. 27.3) and the mean score for benefits of being tobacco free was 1.4 points higher for those exposed to anti-tobacco messages in the adjusted analysis (27.5 v. 26.1). All of these differences were statistically significant (all $p < 0.0001$).

Similarly, Table 3 depicts the mean psychosocial scale scores by exposure to tobacco advertising. The mean scale score for knowledge of health risks was 0.2 points higher for those exposed to tobacco advertising than for those not exposed in the crude analysis (13.2 v. 13.0) and the mean scale score for knowledge of health risks was likewise 0.2 points higher for those exposed to tobacco advertising than for those not exposed in the adjusted analysis (12.6 v. 12.4). Both of these differences were statistically significant ($p < 0.0001$). The mean scale score for benefits of remaining tobacco free was 0.3 points lower for those exposed to tobacco advertising and this difference was statistically significant ($p = 0.0036$) in the crude analysis, but the mean scale score for benefits of remaining tobacco free was only 0.1 points lower in the adjusted analysis and this difference was not statistically significant ($p = 0.0879$).

Table 4 gives the prevalence of intentions to try smoking in the next six months by exposure to tobacco advertising and counter-advertising stratified by grade level. In relation to exposure to tobacco advertising, among 6th graders, the percent of those who intend to try smoking is significantly higher for those exposed to tobacco advertising than for those not exposed (4.8% v. 2.6%, $p < 0.0001$) in the crude analysis and this significant difference also holds in the adjusted analysis (11.6% v. 9.3%, $p < 0.0001$). Among 7th graders, the percent of those who intend to try smoking is significantly higher for those exposed to tobacco advertising than for those not exposed (9.0% v. 3.8%, $p < 0.0001$) in the crude analysis and this significant difference also holds in the adjusted analysis (14.2% v. 9.3%, $p < 0.0001$). Among 8th graders, the percent of those who intend to try smoking is significantly higher for those exposed to tobacco advertising than for those not exposed in the crude analysis (13.9% v. 9.7%, $p = 0.0013$) in the crude analysis and this significant difference also hold in the adjusted analysis (19.7% v. 16.2%, $p = 0.0080$).

With regard to exposure to anti-tobacco messages, among 6th graders, the percent of those who intend to try smoking is not significantly different for those exposed to anti-tobacco messages than for those not exposed after adjustment (10.3% v. 10.2%, $p=0.8351$). Similarly, after adjustment, among 7th graders, the percent of those who intend to try smoking is not significantly different for those exposed to anti-tobacco messages than for those not exposed (12.2% v. 12.2%, $p=0.9712$). However, among 8th graders, the percent of those who intend to try smoking is significantly lower among those exposed to anti-tobacco messages 11.0% v. 15.4%, $p=0.0108$) in the crude analysis and there is also a significant difference in the adjusted analysis (16.3% v. 20.3%, $p=0.0241$).

Table 5 provides the estimates of knowledge, benefits, and intentions by levels of exposure to anti-tobacco messages. A statistically significant dose-response relationship exists for the psychosocial variables based on variety of anti-tobacco messages seen. In the crude analysis, the mean scale score for knowledge of risks monotonically increased by 0.8 points from 12.6 to 13.4 across the exposure levels from none to low to more ($p<0.0001$). In the adjusted analysis, the mean scale score for knowledge increased by 0.8 points from 12.0 to 12.8 across the same three levels ($p<0.0001$). In the crude analysis, the mean scale score for benefits of being tobacco free monotonically increased by 1.7 points from 27.3 to 29.0 across the exposure levels from none to low to more ($p<0.0001$). In the adjusted analysis, the mean scale score for benefits of being tobacco free increased by 1.6 points from 26.1 to 27.7 across the same three exposure levels ($p<0.0001$).

For the intentions variables, by contrast, there is no statistically significant difference in either the crude or the adjusted analyses for either smokers future plans to quit or the non-smokers future plans to initiate smoking. In the crude analysis among non-smokers, their

intention to initiate smoking decreases from 5.8% with no exposure to 4.8% with low exposure and then increases to 5.1% with more exposure, but these difference are not statistically significant ($p=0.27$). In the adjusted analysis among non-smokers, their intention to initiate decreases from 11.9% for those with no anti-tobacco media exposure to 11.1% with low exposure and then increases to 11.3% for those with more exposure, but these differences are not statistically significant ($p=0.41$). In the crude analysis among smokers, their intention to quit decreases from 40.3% of those with no anti-tobacco media exposure to 37.8% for those with low exposure and then increases to 39.5% for those with more exposure, but these differences are not statistically significant ($p=0.92$). In the adjusted analysis among smokers, their intention to quit increases from 40.0% with no anti-tobacco exposure to 40.8% for those with low exposure and then decreases to 39.4% for those with more anti-tobacco exposure, but these differences are not statistically significant ($p=0.97$).

DISCUSSION

This study had the objectives of determining whether the type of smoking message (tobacco advertisements and/or anti-tobacco messages) affected adolescents knowledge regarding the health risks of tobacco use and perceived benefits of being tobacco-free as well as their future intentions—to take up smoking among nonsmokers, or to quit smoking among smokers. Regarding knowledge, the data indicated that students exposed to tobacco advertisements were slightly more knowledgeable about the health risks from smoking than those not exposed to tobacco advertisements (0.2 points higher mean scale score in the adjusted analysis). Initially, this might seem counterintuitive; however, a plausible explanation could derive from the fact cigarette advertisements are required to carry one of four Surgeon General’s warnings—one of which is “Smoking cause lung cancer, heart disease, and may complicate

pregnancy.”³⁵ In other words, because of the presence of the Surgeon General’s warnings on tobacco advertisements, students exposed to tobacco advertising would also have been exposed to the Surgeon General’s warnings of the health risks—which may account for their slightly higher score relative to those not exposed to tobacco advertisements.

Regarding perceived benefits, the major impact of anti-tobacco advertising appears to be to increase the understanding of the health benefits of being tobacco-free. In the adjusted analysis (Table 2) controlling for gender, ethnicity, grade level, and parental connectedness, the mean scale score for those exposed to anti-tobacco messages was still significantly higher than for those not exposed. Although 1.4 units may not seem large, this is actually (on a 28 point scale range) a 5% increase in awareness of benefits as a result of anti-tobacco media exposure. By contrast, the difference in awareness of benefits for those exposed to tobacco messages (Table 3) was only 0.1 unit and not statistically significant. This suggests that anti-tobacco media messages can serve as a form of *positive* reinforcement—that is, playing up the positive health benefits of not smoking rather than emphasizing the negative risks from smoking. Although recent studies have emphasized the effectiveness of anti-tobacco industry approaches (based on the view that negative attitudes towards the tobacco industry will result in fewer individuals initiating smoking),²⁵⁻²⁹ the fact that focusing on health benefits can also be effective provides useful new approaches to frame anti-tobacco messages in the future—especially since the tobacco industry will probably continue to challenge, in court, media messages that criticize industry practices.¹⁰

Regarding the intention to initiate smoking, the fact that the percentage is significantly higher, across all three grade levels, (Table 4) for those exposed to tobacco advertising relative to those not exposed indicates that taking steps to limit exposure to tobacco messages for

adolescents would have a socially beneficial effect. In the 6th and 7th grades, there is no significant difference regarding intention to initiate smoking based on anti-tobacco media exposure; however, in the 8th grade, the percentage of those who plan to initiate smoking is significantly lower for those exposed to anti-tobacco messages than for those not exposed to such messages. Furthermore, the fact that the differences in the percentage of 8th graders with intentions to try smoking in the next six months are near “mirror images” of each other for those exposed to tobacco messages and for those exposed to anti-tobacco messages (19.7% v. 16.2% for tobacco advertising; 16.3% v. 20.3% for anti-tobacco advertising) suggests that this is the age at which students are seriously considering taking up the practice. Because this is cross-sectional data, it is not possible to know when the students were exposed to these messages. However, studies have indicated that interventions to reduce smoking can be effective at lower grade levels (e.g., the 6th grade³⁶), which suggests that anti-tobacco media messages be directed at younger ages (i.e., prior to the 8th grade when the students are actually considering initiating the practice).

This study provides evidence for a dose-response relationship regarding variety of anti-tobacco media exposure and changes in beliefs, which is consistent with earlier studies.^{27,37} Viewing the dose-response relationship as continuous across the eight varieties of exposure, the general trend was increasing (that is, those exposed to higher varieties of anti-tobacco media messages tended to have higher scores on the knowledge and benefits scales). However, the level of increase was small per unit increase in variety of exposure, which is the reason that the effects were analyzed across three broad exposure levels. The effect was most notable regarding the benefits of remaining tobacco free—in the adjusted analysis (Table 5), students with exposure to more than one form of anti-tobacco message had a mean scale score 1.6 points (5.7%) higher than those with no exposure to anti-tobacco media messages. What this suggests

is that increasing the number of venues in which anti-tobacco messages are placed may help to spread the knowledge of the health benefits of being tobacco free. This finding is consistent with a recent study that demonstrated the effectiveness of newer media outlets such as the Internet in reaching adolescents who wanted to stop smoking.³⁸ The variety of anti-tobacco media exposure was not significantly related to the intention to initiate smoking among non-smokers, or quit smoking among smokers. Several factors could account for these results. Although this is a large sample (n=11,128), the number who had become regular smokers is comparatively small (n=551), which may mean that, among this sub-population, there may not be sufficient power to detect differences in intention. Also, in all analyses involving smokers, around 40% indicated that they wanted to quit, which would suggest that they are already knowledgeable of the benefits of quitting and, as a result, more media exposure may not have much impact. Among non-smokers, the non-significant results may derive from the fact that, when the population is considered in aggregate, the notable effect modification based on grade level is obscured.

There are limitations in this study. As a cross-sectional study, only associations can be demonstrated; no inference about causation can be drawn. Although some follow-up studies were done, study participants were not identified by unique identification numbers, which would have permitted longitudinal determinations of changes in perceptions over time. Also, because the study relied on self-reported data, there is the potential that the students did not respond honestly; however, this issue is probably minimized because the surveys were anonymous. With a survey this long (there were 16 different sections), there is the possibility of missing data due to respondent burden. Also, the skip patterns in the study were not as clearly spelled out as they could have been, which may have caused confusion regarding which questions were supposed to be answered (for example, 41 students listed specific places that they had seen anti-tobacco

messages even though they had also indicated that they had not been exposed to anti-tobacco messages). However, because these numbers are small relative to the total population size, the potential misclassification bias may be minimal. Finally, although the study sample is large, all of the respondents are Virginia residents, which means that the results might not be generalizable to adolescents in other states.

CONCLUSION

As noted at the outset of this study, eliminating smoking would have major public health implications because this unhealthy behavior is the leading cause of preventable death. However, because tobacco is a legal product that can be bought and sold in the economic marketplace, public health policy must be formulated in terms of providing effective and accurate information so that the public can make informed choices. In practice, this means that counter-advertising, which emphasizes the known health risks from smoking and the health benefits from not smoking, be implemented and that restrictions be placed on advertising sponsored by tobacco companies. These efforts should be especially directed at adolescents for at least three reasons: 1) this is the age that most smokers take up the practice; 2) adolescents are not developmentally mature enough to make truly “informed” choices about whether to engage in smoking; and 3) the addictive nature of nicotine in tobacco products means that, by the time adolescents are old enough to make truly informed decisions, they have become addicted. Counter-advertising should increase the frequency of anti-tobacco exposure as well as focus on younger ages where the ability to influence behavior would be the greatest.

Based on the empirical evidence presented in this report, counter-advertising and further restrictions on tobacco advertising directed at adolescents can contribute to achieving these public health objectives. Counter-advertising can make adolescents more aware of the health

benefits of remaining tobacco free, which, when coupled with other health promoting attitudes and behaviors (e.g., parental connectedness) might make them less likely to smoking. Also, by placing tighter restrictions on tobacco advertising directed at younger children, fewer adolescents might contemplate taking up the practice. Finally, there is evidence of a “dose-response” regarding both knowledge of the health risks and health benefits of remaining tobacco free. At a policy level, this suggests that disseminating anti-tobacco messages be disseminated in an increasingly wide array of venues.

Table 1. Descriptive Characteristics

| | Total (n=11,128) |
|--|-----------------------------|
| Mean age in years (SE) (range: 9-18 years) | 12.2 (0.01) |
| Male (%) | 48.3 |
| White (%) | 71.9 |
| Grade Level | |
| 6th (%) | 44.2 |
| 7th (%) | 33.9 |
| 8th (%) | 22.0 |
| Closeness to at least one Parent | |
| Not close to either (%) | 1.5 |
| Somewhat close (%) | 13.4 |
| Very close (%) | 85.1 |
| Exposure to Tobacco Advertisements (%) | 41.2 |
| Exposure to Counter-Advertisements (%) | 76.6 |
| Tried Smoking (%) | 30.3 |
| Regular Smoker (%) | 5.0 |

Table 2. Mean Scale Scores for Knowledge of Risks from Smoking & Benefits of Being Tobacco Free by Exposure to Anti-Tobacco Messages, Crude and Adjusted Analyses (n=11,128)

| | Crude Analysis | | | Adjusted Analysis ¹ | | |
|-----------------------------|-----------------------------------|--------------------------------------|---------|-----------------------------------|---------------------------------------|---------|
| | Exposure to Anti-Tobacco Messages | No Exposure to Anti-Tobacco Messages | p-value | Exposure to Anti-Tobacco Messages | Non-Exposure to Anti-Tobacco Messages | p-value |
| Knowledge (SE) ² | 13.3(0.11) | 12.6(0.12) | <0.0001 | 12.7(0.12) | 12.0(0.13) | <0.0001 |
| Benefits (SE) ³ | 28.8(0.21) | 27.3(0.22) | <0.0001 | 27.5(0.22) | 26.1(0.23) | <0.0001 |

¹Covariates in adjusted analyses were race, gender, grade in school, and parental closeness.

²Higher mean scale score indicates more knowledge of risks of tobacco use (range: 3-15)

³Higher mean scale scored indicates more benefits of being tobacco-free (range: 7-35)

Table 3. Mean Scale Scores for Knowledge of Risks from Smoking & Benefits of Being Tobacco Free by Exposure to Tobacco Advertising, Crude and Adjusted Analyses (n=11,128)

| | Crude Analysis | | | Adjusted Analysis ¹ | | |
|-----------------------------|-----------------------------------|--------------------------------------|---------|-----------------------------------|--------------------------------------|---------|
| | Exposure to Tobacco Advertisement | No Exposure to Tobacco Advertisement | p-value | Exposure to Tobacco Advertisement | No Exposure to Tobacco Advertisement | p-value |
| Knowledge (SE) ² | 13.2(0.12) | 13.0(0.12) | <0.0001 | 12.6(0.12) | 12.4(0.12) | <0.0001 |
| Benefits (SE) ³ | 28.2(0.22) | 28.5(0.21) | 0.0036 | 27.0(0.22) | 27.1(0.22) | 0.0879 |

¹Covariates in adjusted analyses were race, gender, grade in school, and parental closeness.

²Higher mean scale score indicates more knowledge of risks of tobacco use (range: 3-15)

³Higher mean scale scored indicates more benefits of being tobacco-free (range: 7-35)

Table 4. Percentage of Non-smoking Students planning to initiate smoking in 6 months, stratified by grade (total n=10,577)

| | 6th Grade (n=4,914) | | | | | |
|--------------------------|----------------------|----------------------|---------|-------------------------------|----------------------|---------|
| | Crude Percent | | | Adjusted Percent ¹ | | |
| | Yes | No | p-value | Yes | No | p-value |
| Tobacco Advertising (CI) | 4.8 (3.6, 6.1) | 2.6 (1.5, 3.6) | <0.0001 | 11.6 (9.2, 13.9) | 9.3 (7.0, 11.6) | <0.0001 |
| Counter-Advertising (CI) | 3.3 (2.2, 4.4) | 3.5 (2.3, 4.9) | 0.65 | 10.3 (8.2, 12.6) | 10.2 (7.8, 12.6) | 0.835 |
| | 7th Grade (n=3,768) | | | | | |
| | Crude ¹ | | | Adjusted ¹ | | |
| | Yes | No | p-value | Yes | No | p-value |
| Tobacco Advertising (CI) | 9.0 (7.5, 10.5) | 3.8 (2.5, 5.2) | <0.0001 | 14.2 (11.3, 17.1) | 9.3 (6.4, 12.1) | <0.0001 |
| Counter-Advertising (CI) | 5.9 (4.6, 7.2) | 6.7 (4.8, 8.6) | 0.446 | 12.2 (9.4, 15.1) | 12.2 (9.0, 15.4) | 0.971 |
| | 8th Grade (n=2,446) | | | | | |
| | Crude | | | Adjusted ¹ | | |
| | Yes | No | p-value | Yes | No | p-value |
| Tobacco Advertising (CI) | 13.9 (10.6, 17.2) | 9.7 (6.4, 12.9) | 0.0013 | 19.7 (15.6, 23.9) | 16.2 (12.1, 20.3) | 0.008 |
| Counter-Advertising (CI) | 11.0 (7.4, 14.6) | 15.4 (11.0, 19.8) | 0.011 | 16.3 (11.6, 21.0) | 20.3 (14.9, 25.7) | 0.024 |

¹Covariates in adjusted analyses were race, gender, and parental closeness.

Table 5. Knowledge, Benefits, and Intentions by Levels of Exposure to Anti-Tobacco Messages, Crude and Adjusted Analyses

| Psychosocial Constructs | Crude Analyses | | | | Adjusted Analyses ¹ | | | |
|--|----------------------|----------------------|----------------------|---------|--------------------------------|----------------------|----------------------|---------|
| | None | Low (1) | More (>1) | p-value | None | Low (1) | More (>1) | p-value |
| Knowledge ² (SE) | 12.6 (0.12) | 13.2 (0.12) | 13.4 (0.12) | <0.0001 | 12.0 (0.13) | 12.6 (0.13) | 12.8 (0.12) | <0.0001 |
| Benefits ³ (SE) | 27.3 (0.22) | 28.4 (0.21) | 29.0 (0.21) | <0.0001 | 26.1 (0.23) | 27.2 (0.23) | 27.7 (0.22) | <0.0001 |
| Intentions | | | | | | | | |
| Percent Try Smoking in 6 Months ⁴ (95% CI) | 5.8 (4.1, 7.4) | 4.8 (3.2, 6.5) | 5.1 (3.5, 6.6) | 0.27 | 11.9 (10.2, 13.6) | 11.1 (9.4, 12.8) | 11.3 (9.7, 12.9) | 0.41 |
| Percent Plan to Quit ⁵ (95% CI) | 40.3 (30.8, 49.7) | 37.8 (29.5, 46.1) | 39.5 (33.4, 45.7) | 0.92 | 40.0 (28.2, 51.8) | 40.8 (30.2, 51.4) | 39.4 (30.2, 48.5) | 0.97 |

¹Covariates were race, gender, grade in school, and parental closeness.

²Mean scale score for knowledge of risks from smoking (3 items, range 3-15). Higher score indicates more knowledge (n=11,128).

³Mean scale score for benefits of remaining tobacco free (7 items, range 7-35). Higher score indicates more benefits (n=11,128).

⁴Note: among nonsmokers (n=10,577)

⁵Noe: among regular smokers (n=551).

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